

ARCTOSTAPHYLOS GABILANENSIS (ERICACEAE), A NEWLY DESCRIBED
AURICULATE-LEAVED MANZANITA FROM THE GABILAN
MOUNTAINS, CALIFORNIA

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ABSTRACT

Arctostaphylos gabilanensis V. T. Parker and M. C. Vasey is a newly described diploid manzanita species from the Gabilan Mountains in San Benito and Monterey counties, CA. This species demonstrates characteristics that suggest a hybrid origin, with auriculate leaves similar to many maritime species, but also with inflorescence characters including large globose fruits and fused nutlets that indicate a relationship to *A. glauca*. Plants are restricted to soils of granitic origin between 300–700 m from just SE of Fremont Peak, south to near the northern boundary of the Pinnacles. We also provide a key to the northern auriculate-leaved *Arctostaphylos* species of the San Francisco Bay and Monterey Bay regions.

Key Words: Ericaceae, Arbutioideae, *Arctostaphylos*, Gabilan Mountains, diploid hybrid speciation.

In the early 1990's, two botanists independently collected a new manzanita species from the Gabilan Mountains, along the borders of San Benito and Monterey counties, California. Dean Taylor was surveying the area around Gloria Valley in the central Gabilan Mountains and came across a small population of a species he could not determine. Around the same time, Vern Yadon was collecting plants in an area southeast of Fremont Peak in the northern Gabilan Mountains and found a population of manzanitas with which he was not familiar. But it was not until early 2002 that both botanists encountered us at talks and workshops on manzanitas and mentioned their collections. Knowing of no auriculate-leaved species in the Gabilan Mountains, we spent the next year investigating, making collections of both populations and surveying other areas.

In this paper we describe *A. gabilanensis* and its distribution. Additionally, we provide a key for determining auriculate-leaved manzanitas of the northern central coast ranges. We follow Hickman (1993) for the nomenclature of all other species.

SPECIES TREATMENT

Arctostaphylos gabilanensis V. T. Parker and M. C. Vasey, sp. nov. (Fig. 1). TYPE: USA, California, San Benito County, granitic ridge SE of Fremont Peak, above Pescadero Creek, 22 July 2002, V. T. Parker and M. C. Vasey 1087. (Holotype, CAS, Isotype, JEPS).

Frutices erecti vel arborescentes, 1–5 m alti; lignotuber absens; ramorum cortex levis, ruber; ramuli pubescentes, glandulis sessiles inter trichomes; folia viridi-grisea, ovata, 15–35 mm longa, 11–24 mm lata, ± sessilia, petiolis interdum 1–4 mm lon-

gis, basis auriculata, apex obtusus, interdum apiculatus, lamina canescens, stomatum numerus pilis utrinque; inflorescentiae nascentes pendulae, paniculatae, ramuli 1–4, pubescentes, glandulis sessiles inter trichomes, bractea basalis foliacea, 6–8 mm longa, bractae floralae succulentae, subulatae, 2–4 mm longae; corolla alba vel roseo-alba, urceolata vel conoidea, 6–8 mm longa; ovarium canescens; drupa globosa, glabra, rufa-badia, 10–15 mm diametro, mesocarpium obscurum ubi maturum, endocarpium singulare 6–8 semina continens.

Erect shrub or small tree, 1–5 m high, main stem without burl; branches covered by thin medium- to dark-red bark, branchlets pubescent, small, sessile glands present among hairs; leaves gray-green, ovate, 15–35 mm long, 11–24 mm wide, ± sessile, petioles 1–4 mm long, base auriculate, apex obtuse, sometimes with small tip, blade canescent, stomatal density similar on both leaf surfaces; inflorescence erect to pendent when immature, paniculate with 1–4 branches, glandular pubescent, basal bract leaf-like, 6–8 mm long, floral bracts fleshy, awl-shaped, appearing concave when fresh, 3–4 mm long, spreading, generally glandular pubescent; pedicels usually pubescent but sometimes glandular pubescent or glabrous, 5–10 mm long, corolla white, sometimes tinged with pink, usually urceolate but sometimes conical, 6–8 mm long, ovary usually canescent; fruit a globose drupe, 10–15 mm in diameter, glabrous, red-brown, mesocarp obscure at maturity, seeds usually 6–8, contained within single hard endocarp.

This species is variable in a few characters; most leaves have a fine canescent layer, sometimes with small glands sitting on the surface, especially around the petiole, however, all leaves lose some or all of their pubescence as they age. While stems and rachises are consistently pubescent with sessile glands distributed between the hairs, the pedicels are more variable, usually pubescent, sometimes

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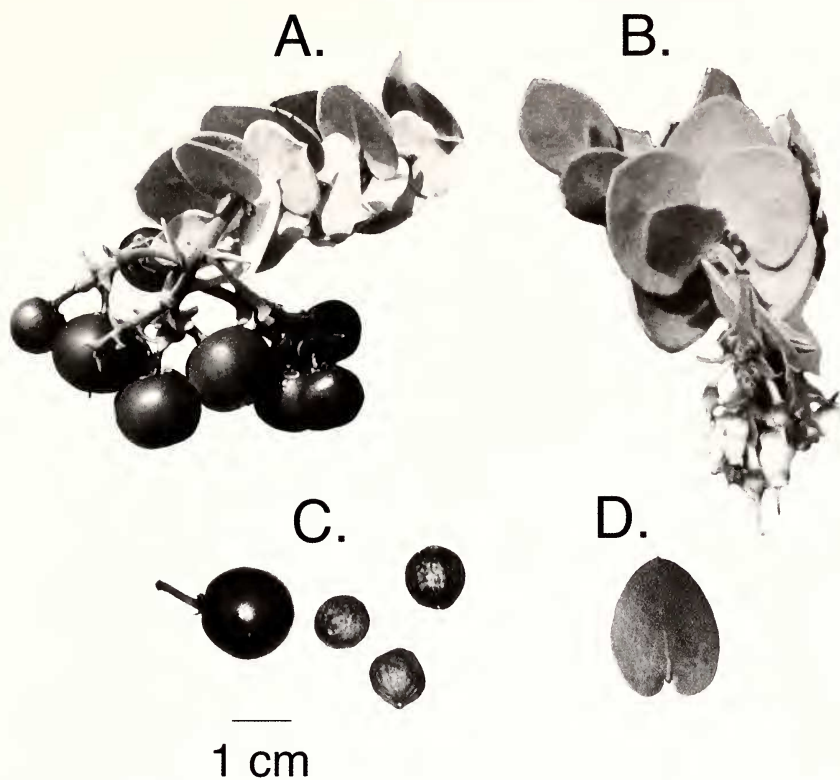


FIG. 1. *Arctostaphylos gabilanensis*. A). Branchlet in fruit; B). Branchlet in flower; C). Fruit and several nutlets; D). Leaf in silhouette.

with sparse glands associated with the hairs or essentially glabrous, especially in the southern population. Most individuals have pubescent ovaries, and as ovaries mature to fruit the hair is lost and the fruit coat is smooth; a few individuals appear to lack pubescence on the ovaries. Generally, the southern population appears less glandular than the northern.

Ploidy level. Immature flowers just beginning to swell were collected from the northern population on 13 January 2003 and preserved in Carnoy's solution. Later, Kristina Schierenbeck (CSU Chico) and Greg Wahlert (SFSU) determined that *A. gabilanensis* is a diploid with $n = 13$ based upon counts of chromosomes from several individuals.

Distribution and habit. *Arctostaphylos gabilanensis* is found between 300–700 m, restricted to granitic derived soils in the Gabilan Mountains from near Fremont Peak in the north, south to an area near Gloria Valley north of the Pinnacles. Two populations are known. The southernmost is small with less than 30 individuals (near Gloria Valley) while the northern population is extensive, sparsely covering an area of approximately 1000 ha. The northern population is found SE of Fremont Peak, generally confined to a single extensive ridgeline north of and surrounded on three sides by the beginning stretches of Pescadero Creek.

The southern population is found in chaparral dominated almost exclusively by *Adenostoma fasciculatum*. One individual of *A. glauca* is within the population; many populations of *A. glauca* are also found to the east of *A. gabilanensis* and throughout much of the interior areas of the central and southern Gabilans. If other localities exist in the range between the known southern and northern populations of *A. gabilanensis*, *A. glauca* and *A. gabilanensis* may share other sympatric sites.

The northern population is found in a rich chaparral-pine woodland dominated by *A. gabilanensis*, *A. tomentosa* subsp. *crustacea*, *Adenostoma fasciculatum*, *Quercus wislizenii*, *Garrya elliptica*, and *Ceanothus papillosus*. Species of note include a disjunct population of *Vaccinium ovatum* (V. Yadon personal communication) and an extensive population of *Salvia sonomensis*. *Pinus coulteri* occurs scattered and prominent throughout the site.

Other *Arctostaphylos* species besides *A. gabilanensis* and *A. glauca* found in the Gabilan Mountains include *A. tomentosa* subsp. *crustacea* (usually on slopes facing the Salinas Valley), *A. pungens* (volcanic soils in the southern Gabilans) and occasional *A. glandulosa*. Of these species, *A. gabilanensis* appears to share some characters with only *A. glauca*. Auriculate-leaved species were not known previously from the Gabilan range, although we also found a small disjunct population of

A. pajaroensis west across Pescadero Creek from the northern population of *A. gabilanensis* on a ridge adjacent to the Salinas Valley, approximately 20 km from the nearest previously known population. This represents a range extension of *A. pajaroensis* into San Benito County. Other auriculate-leaved species in the region include *A. auriculata* (Mt. Diablo) and *A. pallida* (Oakland and Berkeley hills) to the northeast; *A. imbricata* (San Bruno Mt), *A. montaraensis* (San Bruno and Montara Mts), *A. regismontana* (King's Mt region), *A. glutinosa* (s. Santa Cruz Mts), and *A. andersonii* (s. Santa Cruz Mts) in the Santa Cruz Mountains; *A. pajaroensis* is found to the northwest of the Gabilan Mts in the Pajaro Hills while to the southwest is *A. hooveri* in the northern Santa Lucia Mountains. Of these species, *A. gabilanensis* shares more morphological characteristics like leaf shape and pubescence patterns with *A. auriculata* and *A. glutinosa* than with the others.

Taxonomic relationships. While conjectural, *A. gabilanensis* appears to be of diploid hybrid origin combining characters from an auriculate-leaved species with those of *A. glauca*. The vegetative morphological characteristics indicate genetic origins from an auriculate-leaved species of *Arctostaphylos*, which are generally restricted to foggy and maritime conditions. Of the dozen auriculate species that occur from the San Francisco Bay Area south toward San Luis Obispo, *A. gabilanensis* does not resemble nearby species like *A. pajaroensis* in vegetative characters. Instead, *A. gabilanensis* seems to share more characters with species like *A. glutinosa* (approximately 70 aerial km away), *A. auriculata* (approx. 125 km), and *A. luciana* (approx. 150 km). These three species exhibit a glaucous-gray waxy layer on leaves covered early with short white downy hairs that may thin later as in *A. gabilanensis*. Both *A. auriculata* and *A. luciana* lack glands of any sort on branchlets, while *A. gabilanensis* is sparsely glandular on the branchlets with short or sessile glands and *A. glutinosa* is glandular-hispid or glandular-setose. None of these auriculate-leaved species from central California share reproductive characters with *A. gabilanensis* (Table 1).

Reproductive characters such as the bracts of the inflorescence of *A. gabilanensis*, the large globose fruit and the fused nutlets suggest a relationship with *A. glauca*, a wide-ranging species of relatively hotter and more arid sites in the inner coast range from Mt. Diablo south to Baja California. *Arctostaphylos glauca* is similar in morphology for inflorescence characters and differs only in the fruit surface being viscid; leaf shape and leaf and stem pubescence clearly differs between these two species. *Arctostaphylos gabilanensis* also resembles *A. refugioensis* from the Santa Ynez Mts of Santa Barbara Co. in general appearance and in fruit characters. Gankin (1967) hypothesized *Arctostaphylos refugioensis* also is of hybrid origin between *A. glauca* and an

TABLE 1. COMPARISON OF SELECTED CHARACTERS AMONG SOME CENTRAL CALIFORNIA AURICULATE-LEAVED ARCTOSTAPHYLOS SPECIES. 'Leaf stomata' refer to whether stomata are on both surfaces or only the lower leaf surface. 'Bark' refers to whether the lower stems have a smooth, reddish bark or a rough or shreddy, usually grayish bark. 'Glands on branchlets' indicates whether glands occur on branchlets, and if so, where they occur. 'Fruit' are found either as depressed globose or globose, while 'nutlets' are used to refer to the hardened endocarp covering of the seed, and whether they are separable or fused into a single structure.

	Leaf stomata	Bark of lower stems	Glands on branchlets	Fruit shape	Fruit diam mm	Nutlets	Fruit surface
<i>A. andersonii</i>	lower	smooth	hispid-setose	depressed	6-8	separable	glandular-viscid
<i>A. auriculata</i>	both	smooth	none	depressed	5-10	separable	pubescent-smooth
<i>A. gabilanensis</i>	both	smooth	sessile	globose	10-15	fused	glabrous
<i>A. glutinosa</i>	both	smooth	hispid-setose	depressed	7-14	separable	glandular-viscid
<i>A. hooveri</i>	both	smooth	hispid-setose	depressed	10-15	separable	glandular-viscid
<i>A. imbricata</i>	both	smooth	hispid-setose	depressed	6-7	separable	glandular-viscid
<i>A. luciana</i>	both	smooth	none	depressed	6-12	separable	glabrous
<i>A. montaraensis</i>	both	smooth	hispid-setose	depressed	6-7	separable	glandular-viscid
<i>A. pajaroensis</i>	lower	rough-shreddy	none	depressed	6-8	separable	pubescent-smooth
<i>A. pallida</i>	both	smooth	none	depressed	8-10	separable	glandular-viscid
<i>A. regismontana</i>	both	smooth	hispid-setose	depressed	6-8	separable	glandular-viscid
<i>A. refugioensis</i>	both	smooth	hispid-setose	globose	10-15	fused	glabrous

auriculate-leaved species; *A. refugioensis* is the only other auriculate-leaved species that has a large (10–15 mm), globose fruit with fused nutlets. These two species differ in a number of other characters, for example *A. gabilanensis* has short canescent-style pubescence with sessile glands beneath while *A. refugioensis* is densely hispid or hispidulous with glands on the tips of these long hairs. *Arctostaphylos refugioensis* shares with *A. glauca* a very smooth surface on the fused nutlets, while *A. gabilanensis* is more variable, with nutlets slightly rugulose. The nutlet surfaces of two other species with fused nutlets, *A. rainbowensis* and *A. parryana* ssp. *tumescentis*, are similar to that of *A. gabilanensis* in the specimens from our collection.

Many species within *Arctostaphylos* are proposed to be of diploid hybrid origin and these are often narrowly distributed and restricted to a specific soil type or climatic condition (e.g., Howell 1952; Gankin 1966, 1967; Wells 2000). Recent studies (Rieseberg 1997; Rieseberg and Carney 1998) suggest that species of hybrid origin provide successful means of adapting to new habitat conditions, a process known as reticulate evolution.

This newly described manzanita species may well represent an example of this process. *Arctostaphylos gabilanensis* is found in areas that receive muted fog influences. The presence of this combination of maritime fog- and inner coast range-influenced characteristics in *A. gabilanensis* supports models of adaptation to an intermediate habitat (Anderson 1948; Anderson and Stebbins 1954) and indicates a steep environmental gradient in the Gabilan Mountains that may be a natural laboratory for ecological adaptation on a small spatial scale. Much of the Gabilan Mountains are relatively unexplored by botanists compared to other parts of coastal California. While known better for its striking volcanic Pinnacles, the granitic habitats of the Gabilan range deserve more attention from specialists of all types.

Special status consideration. As far as we have been able to determine, *Arctostaphylos gabilanensis* is restricted to two populations, both of which are narrowly distributed. Because of its restricted distribution and the small number of individuals, particularly in the southern population, we recommend that a special status for conservation purposes be considered.

KEY TO AURICULATE-LEAVED MANZANITAS OF THE SF BAY AND MONTEREY BAY REGIONS

1. Stomata only on lower leaf surface
 2. Stems smooth red, large shrubs of forest edges, S. Santa Cruz Mts *A. andersonii*
 - 2'. Stems rough, gray shreddy barked, sandy soils, Pajaro Hills *A. pajaroensis*
- 1'. Stomata on both leaf surfaces.
 3. Fruit globose (10–15 mm diam.), nutlets fused, granitic soils, Gabilan Mts. *A. gabilanensis*
 - 3'. Fruit depressed globose (6–14 mm diam.), nutlets separable
 4. Stems lacking glands
 5. Fruit glandular-hispid, chaparral, Berkeley-Oakland Hills *A. pallida*
 - 5'. Fruit smooth to sparsely pubescent, lacking glands, Mt. Diablo *A. auriculata*
 - 4'. Stems glandular-hispidulous to glandular-setose
 6. Leaves essentially glabrous
 7. Plants relatively prostrate or mounding, < 0.5 m, San Bruno Mt. *A. imbricata*
 - 7'. Plants shrubs to small trees, > 0.5 m, San Bruno & Montara Mts. *A. montaraensis*
 6. Leaves with some pubescence
 8. Leaves curving upward towards tip, boat-like, light-green, dull, glandular-hispid 3–6 cm length, central Santa Cruz Mts (King's Mt and Montara Mt) *A. regismontana*
 - 8'. Leaves flat, grey-green, canescent to sparsely so. Monterey shale, southern Santa Cruz Mts. *A. glutinosa*

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